Long-term development strategy
of the V. G. Baryakntar Institute of Magnetism of the NAS of Ukraine

V. G. Baryakntar Institute of Magnetism of the National Academy of Sciences of Ukraine is a leading research institution in Ukraine in the field of physics of magnetic phenomena and magnetic materials. The main areas of scientific activity of the Institute are fundamental research on the physics of condensed matter and magnetic phenomena, applied research and development on the use of magnetic phenomena and materials for the needs of electronics and computing, medicine, energy industry, heavy industry, and other spheres of the economy.

The Institute's activities include:

– conducting fundamental and applied research in the field of magnetic phenomena and magnetic materials with the aim of obtaining new world-class knowledges and their practical implementation, taking into account the interests of national industry;

– publishing the results in leading scientific journals, promoting the results of research at international scientific conferences, congresses, and forums with the aim of further integration into the global scientific community;

– searching for and analyzing current scientific and technological problems, forming priority scientific directions;

– obtaining patents, implementing inventions created at the Institute, cooperating with industry, commercializing research results;

– extensive cooperation with domestic and foreign scientific institutions, higher education institutions, and industry;

– training of PhDs and DSc in postgraduate and doctoral programs in the specialties E5 - “Physics and Astronomy” and E6 - “Applied Physics and Nanomaterials.”

The strategic development goals of the Institute:

• Transforming the Institute into a leading scientific, educational, and innovative center in Ukraine in the field of physics of magnetic phenomena and materials.

• Creating favorable conditions for the functioning of existing and the formation of new scientific schools of the Institute as a center of knowledge and training of modern highly qualified specialists with in-depth knowledge of the physics of magnetic phenomena and materials.

• Enhancing the international reputation of the Institute by ensuring high-quality scientific research, joint research projects, and grant activities.

• Updating the equipment base of the Institute, creating new experimental facilities for conducting advanced research in the field of condensed matter physics.

• Involving young people in scientific activities at the Institute, in particular by creating joint educational and scientific laboratories with higher education institutions in Ukraine, creating conditions for pre-diploma internships and the completion of diploma theses by senior students in the Institute's departments.

• Introducing modern mechanisms to motivate the Institute's scientific staff to pursue continuous professional growth, self-development, and creative self-realization, in particular by encouraging and facilitating professional development, internships (including abroad), and membership in relevant organizations and societies.

Main directions of the Institute's perspective scientific research for 2023-2032:

1. ***Development of fundamental principles of condensed matter physics and magnetic phenomena:***
   – Mesoscopic and quantum effects in magnetics and magnetic nanostructures;
   – Ultrafast spin dynamics in magnetically ordered systems;
   – Fundamental problems of thermodynamics and kinetics of condensed matter.
2. ***Research and development of new functional magnetic materials:***
   – Physical bases of creation of materials with controlled magnetostructural and magnetocaloric characteristics, magnetically controlled phase transitions;
   – Methods of creation and modification of composite functional materials and surfaces under the influence of extreme conditions;
   – Metamaterials, multiferroics, functional magnetic materials and structures for microwave electronics;
   – Magnetoplastic and magnetorheological effects in functional structures.
3. ***Spintronics and magnonics:***
   – Magnetotransport properties and spin transfer in heterogeneous magnetics, spin-valve, spin-tunnel and spin-injection nanostructures;
   – Spin waves in nanostructured magnetics, nonlinear spin-wave interaction and magnetic solitons;
   – Development of operation principles of elements and systems of magnon logic, analog spin-wave information processing systems and non-Boolean systems;
   – Control of the magnetic state of spintronic nanostructures, development of the principles of creating magnetic random access memory;
   – Spin-calorimetry.
4. ***Magnetic sensors, systems for energy and resource saving, environmental protection, defense and dual-use industry:***
   – Development of magnetic sensors and matrix transducers;
   – Methods of magnetic non-destructive testing and diagnostics of functional and structural materials;
   – Optical systems for diagnostics of the human body.
5. ***Biomagnetism and problems of interaction of magnetic field with biological objects.***